

## **Coastal Ocean Circulation Experiment off Senegal (COCES)**

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[http://poseidon.ogs.trieste.it/sire/drifter/coces\\_main.html](http://poseidon.ogs.trieste.it/sire/drifter/coces_main.html)

### **LONG-TERM GOALS**

To investigate the dynamics of coastal areas dominated by buoyancy input and wind forcing, influenced by complex topography and interacting with the deep ocean. To improve the understanding of coastal marine environmental evolution, with particular emphasis on eddy dynamics.

### **OBJECTIVES**

The general objective of the COCES project is to investigate the coastal dynamics off NW Africa in the tropical Atlantic Ocean. In particular, it is planned to study the near-surface dispersion and circulation off the coast of Senegal, a region strongly influenced by coastal upwelling dynamics and affected by the runoff of an important river, using drifter observations and ancillary satellite data (SST and ocean color) over about a year (from spring 2009 to winter 2010), in collaboration with local oceanographers.

### **APPROACH**

Surface drifters will be deployed at key locations on the continental shelf and slope off Senegal to maximize the geographical coverage in the study area and to construct maps of mean circulation and eddy variability under winter (upwelling) and summer conditions.

Some drifters will be deployed near the vicinity of the mouth of the major rivers to study the river plume dynamics under several wind (e.g., NE upwelling favorable and SW downwelling favorable winds) and discharge rate conditions.

All the drifter data will also be analyzed in concert with satellite images (SST and ocean color) to describe qualitatively the surface dynamics, with particular focus on mesoscale circulation features such as eddies and filaments.

Training and capacity building activities are also proposed to teach Senegalese people to operate drifters, to process their data, and to analyze the scientific results obtained from them.

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## WORK COMPLETED

SVP and CODE drifters were purchased and shipped to Dakar, Senegal in winter 2009. The P.I. and Drs. Niiler and Centurioni visited Dakar in May 2009 to meet with local oceanographers and discuss the planning for the drifter deployments. Local oceanographers were trained to turn the drifter on/off and to deploy them.

The first cluster of 3 SVP drifters was deployed on 22 May 2009, 10-15 nm northwest of the Pointe des Amaldies (Dakar) by the P.I., Centurioni and local collaborators. As of 14 October 2009, only one drifter is still operational in the tropical Atlantic, while the other two units have stopped transmitting (drifter a92019 malfunctioned after 6 days of drift on 28 May 2009 and drifter a92020 was picked up in front of Saint Louis on 8 June 2009, see Figure 1).

The P.I. and Drs. Niiler, Centurioni and Lazar met in Paris in late September to finalize the literature review on the oceanography in the northeastern tropical Atlantic Ocean, to assess the progress of the project and to plan future drifter deployments. It was decided that all the remaining drifters will be deployed off the coast of Senegal during the upcoming upwelling season (December 2009 to March 2010). Deployments will be conducted by local collaborators with the help of Dr. Lazar and the P.I.

The NEMED web pages were created. They provide basic information on the project, near real time (updated on a daily basis) products such as graphs with drifter trajectories and with times series of position (latitude and longitude, speed, sea surface temperature, battery voltage, drogue presence parameter, etc.). A status table (Table 1) is also included to monitor the drifter array. The drifter positions have also been implemented in Google Earth (see Figure 1). The URL address of the NEMED main page is: [http://doga.ogs.trieste.it/sire/drifter/coces/coces\\_main.html](http://doga.ogs.trieste.it/sire/drifter/coces/coces_main.html)

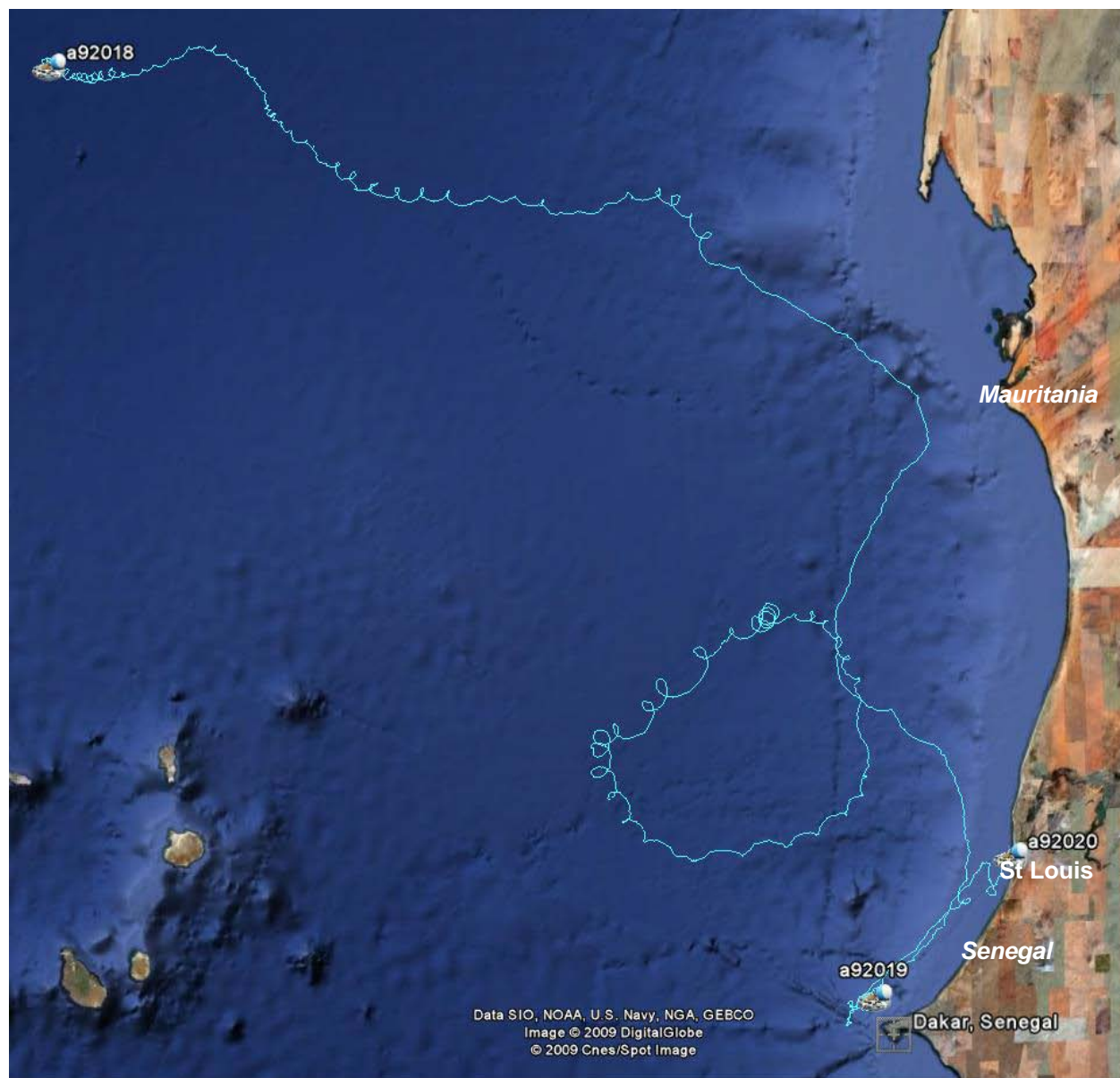
***Table 1. Status table for the drifters deployed in the Atlantic Ocean off Senegal in May 2009 as it appeared on the COCES web pages on 14 October 2009.***

<i>Status Table</i>									
Institute	WMO	Argos	Deploy Date	Lat	Lon	Last Date	Lat	Lon	Status
OGS	13541	a92018	22/05/09 10:39	14.883	-17.773	14/10/09 23:40	21.847	-23.978	●
OGS	13542	a92019	22/05/09 10:50	14.875	-17.683	28/05/09 21:24	14.98	-17.601	●
OGS	13543	a92020	22/05/09 11:00	14.867	-17.665	08/06/09 22:45	15.99	-16.552	●
<div><div>●: dead</div><div>●: working without position</div><div>●: alive</div><div>●: stranded</div></div>									

## RESULTS

The drifters deployed off Pointe des Amaldies moved towards the northeast along the coast of Senegal in late May and early June 2009 (Figure 1). One instrument (a92022) reached the latitude of Saint Louis near the northern border of Senegal. Another one (192018) proceeded northward and westward in the open tropical Atlantic. It then described a cyclonic circulation feature (diameter of ~200 km)

before moving northward west of Mauritania and ultimately drifting towards the west in the North Equatorial Current between 20°N and 22°N. Inertial motions are ubiquitous in the motion of this long-lived drifter, as depicted by the preponderance of small anticyclonic loops along its trajectory.



***Figure 1. Trajectories of the three drifters in eastern tropical Atlantic Ocean. Drifter identification numbers are posted at the end of the tracks and indicate the drifter positions on 13 October 2009.***

## **IMPACT/APPLICATION**

The scientific impact of this project is to increase our understanding of the coastal dynamics off NW Africa and its interaction with the tropical Atlantic Ocean. Future application could be the validation of diagnostic numerical models and the assimilation of the drifter data into prognostic numerical models of coastal ocean circulation.

## **RELATED PROJECTS**

In addition to national programs conducted by collaborators in Senegal, the COCES project is related to the Global Drifter Program (GDP) in the Atlantic Ocean (P.I. : Dr. R. Lumpkin, NOAA/AOML, Miami).

<http://www.aoml.noaa.gov/phod/dac/gdp.html>